INSTRUCTION BOOK

FOR

ANTENNA AT-249/GRD

MANUFACTURED BY

RAYTHEON MANUFACTURING COMPANY

Order No. 3106 — Phila-51-01

15 September 1953

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Figure 1. Antenna AT-249/GRD in use.

Note. This instruction book will be replaced by TM 11-5058 which, when published, will be listed in SR 310-20-4.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

This instruction book contains instructions for the installation, operation, maintenance, and repair of Antenna AT-249/GRD (fig. 1). In addition to these instructions there are two appendixes covering a list of references and an identification table of parts.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army materiel and equipment.

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745-45-5.

b. DA AGO Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in SR 700-45-5.

c. DA AGO Form 11-238, Operator First Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form.

d. DA AGO Form 11-239, Second and Third Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form.

e. Use other forms and records as authorized.

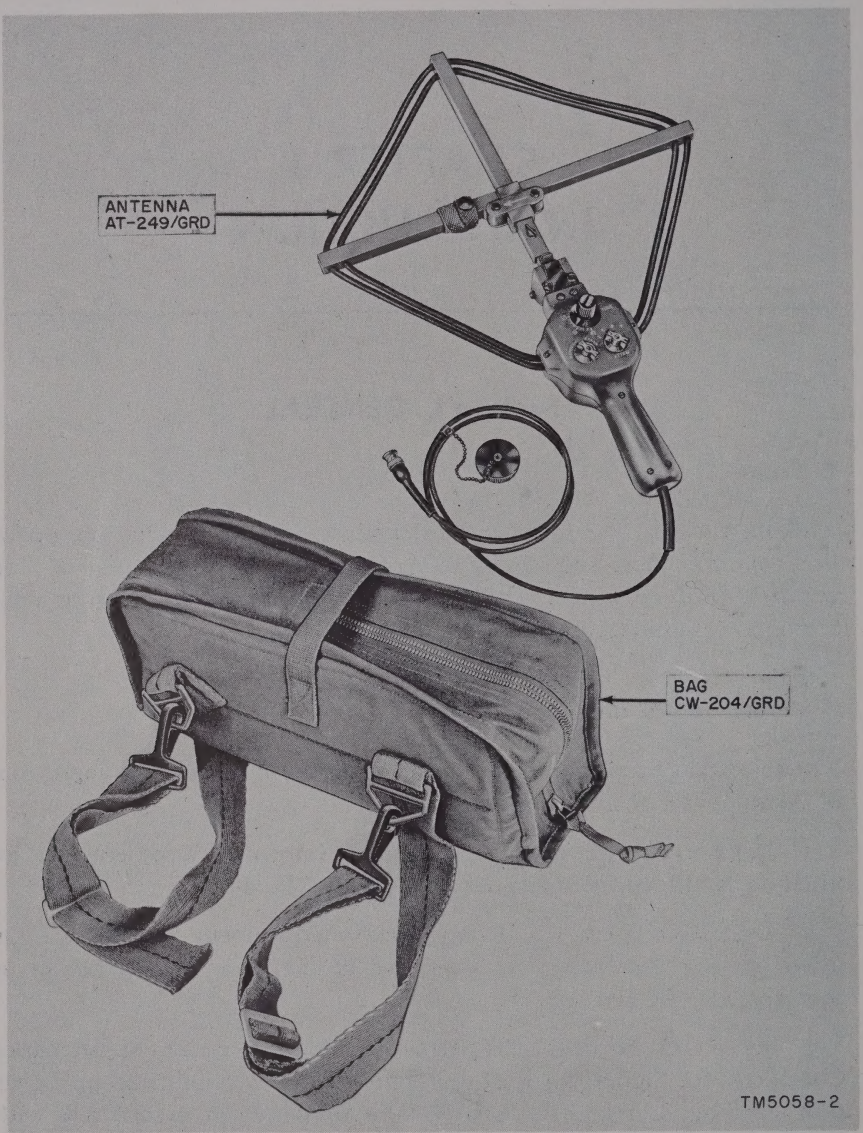

Figure 2. Antenna AT-249/GRD and Bag CW-204/GRD.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

a. Antenna AT-249/GRD, when connected to Radio Set AN/PRC-6, comprises an effective homing device which permits the radio operator to find the direction of a radio transmitter tuned to his frequency and to proceed toward it. Highly accurate bearings generally are not required for homing, therefore an azimuth scale is not provided. When desired, approximate azimuth readings can be obtained by sighting a pocket compass in the direction of the indicated bearing.

b. Bag CW-204/GRD provides a means of carrying and stowing Antenna AT-249/GRD, Radio Set AN/PRC-6, and accessories (fig. 2).

4. Technical Characteristics of Antenna AT-249/GRD

Frequency range ..... Continuously tunable from 47 to 55.4 mc (megacycles).
Type of antenna ..... Unshielded loop.
Provision for sensing ..... Built-in SENSE or NORMAL switch.
Output control ..... Four position step attenuator.

5. Packaging Data

When packaged for export shipment, Antenna AT-249/GRD is wrapped in wadding; placed, with desiccant, within a moistureproof-vaporproof barrier; wrapped with corrugated paper and placed in the lower compartment of Bag CW-204/GRD. The bag is then put in a cardboard box which is inclosed within a waterproof barrier, producing a package measuring 16½ inches long, 7¾ inches wide, and 6½ inches deep and weighing approximately 6¾ pounds. Sixteen of these boxes are then placed in a wooden export crate that has been lined with a waterproof bag. The crate is approximately 33½ inches long, 29¼ inches wide, and 17¾ inches deep. It has a volume of 10 cubic feet, and it weighs approximately 153 pounds.

Note. Items may be packaged in a manner different from that shown, depending on the supply channel.

6. Table of Components (fig. 2)

Component	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu ft)	Unit weight (lb)
Antenna AT-249/GRD	1	20¼	3½	14⅝	.61	2
Bag CW-204/GRD	1	8⅛	5½	16½	.43	2.6

Note. This list is for general information only. See appropriate supply publications for information pertaining to requisition of spare parts.

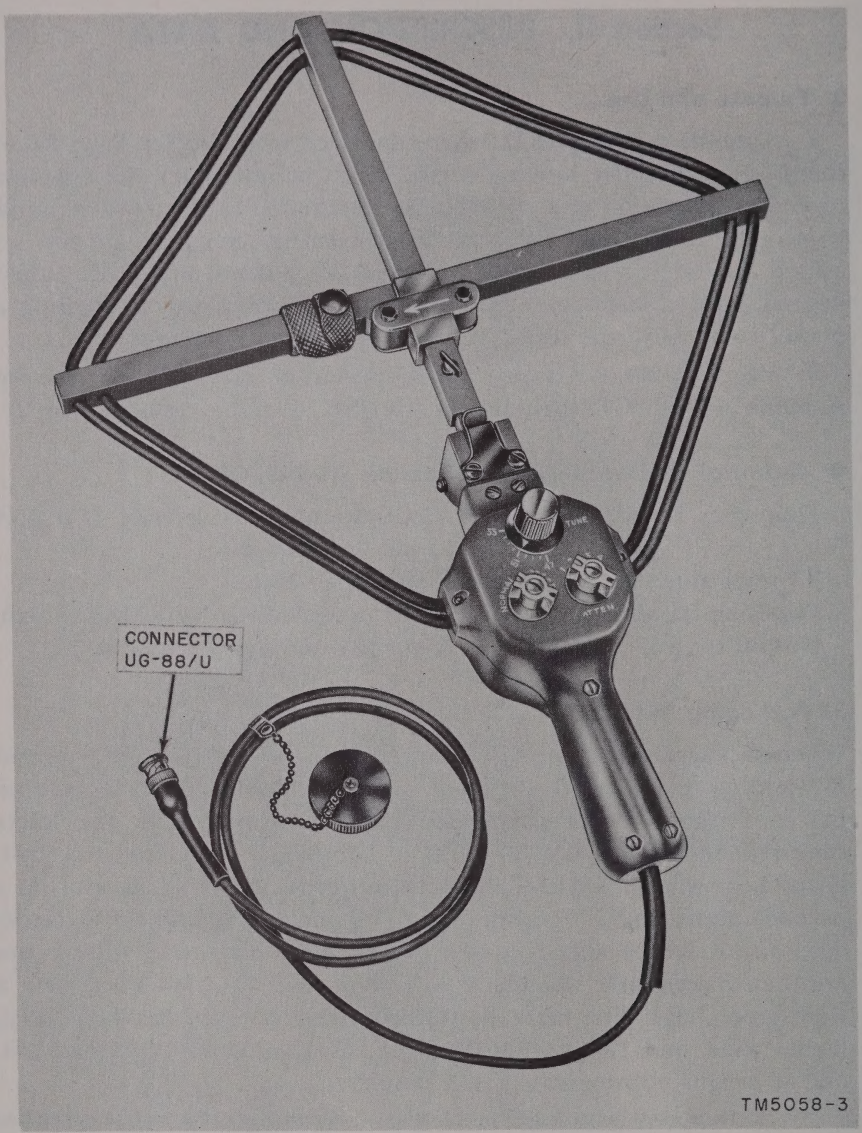

Figure 3. Antenna AT-249/GRD.

7. Description of Antenna AT-249/GRD

Antenna AT-249/GRD (fig. 3) consists of an unshielded loop wound on a collapsible phenolic frame; a housing which contains a coupling transformer, a tuning capacitor, a sense switch, and an attenuator; a 4-foot transmission line; and a connector shorting-cap.

a. The loop consists of two parallel-connected, insulated conductors spaced 1/8 inch apart and mounted on a phenolic frame. The housing and handle are molded plastic and form an extension of one of the

frame members. The housing is above the handle and has all of the operating controls mounted on its front panel.

b. A 4-foot length of transmission line extends through the bottom of the handle and is terminated in a plug used to connect Antenna AT-249/GRD to the homing antenna input jack of Radio Set AN/PRC-6. The connector shorting-cap is attached to the transmission line by a short chain and is used to short-circuit the regular antenna jack on Radio Set AN/PRC-6 when homing operation is desired.

8. Description of Bag CW-204/GRD

Bag CW-204/GRD (fig. 4) provides a means of carrying and stowing Antenna AT-249/GRD, Radio Set AN/PRC-6, and accessories. It is constructed of a cotton duck material which is moisture and fungus resistant.

Figure 4. Bag CW-204/GRD.

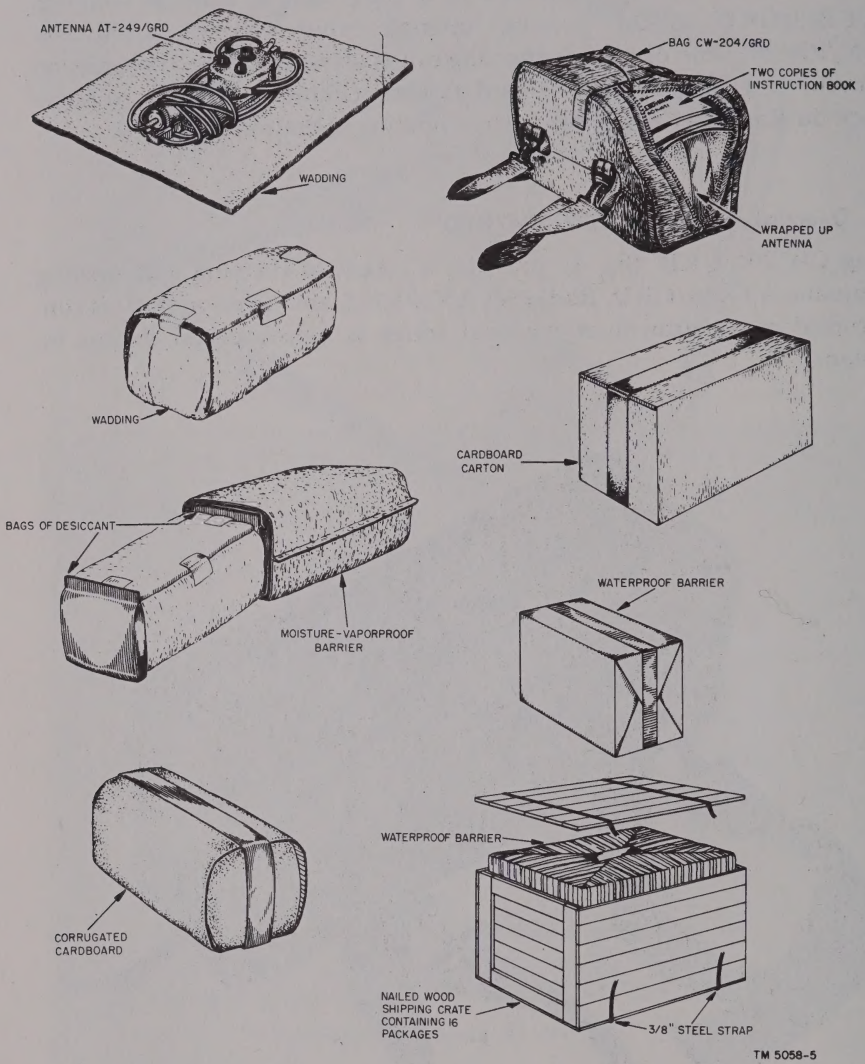

Figure 5. Antenna AT-249/GRD and Bag CW-204/GRD, packaging diagram.

CHAPTER 2
OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF ANTENNA AT-249/GRD

9. Uncrating, Unpacking, and Checking New Equipment

Note. For used or reconditioned equipment refer to paragraph 11.

a. GENERAL. Equipment may be shipped in oversea packing cases or in domestic packing cases and sometimes in Bag CW-204/GRD. When new equipment is received, select a location where the equipment may be unpacked without exposure to the elements. Aside from checking to make sure that all of the equipment is present and undamaged, no special uncrating and unpacking procedures are necessary for equipment shipped in Bag CW-204/GRD.

Caution: Be careful in uncrating, unpacking, and handling the equipment; it is easily damaged.

b. STEP-BY-STEP INSTRUCTIONS FOR UNCRATING AND UNPACKING EXPORT SHIPMENTS (fig. 5). (1) Cut and fold back the steel straps.

(2) Remove the nails with a nail puller. Remove the top and one side of the packing case. Do not attempt to pry off the top; the equipment may become damaged.

(3) Remove the moistureproof barrier and any excelsior or corrugated paper covering the boxes inside the case.

(4) To completely unpack a single unit, remove one of the boxes from the crate.

(5) Remove the barrier from the box, open the box, and lift out Bag CW-204/GRD.

(6) Open the zipper on the bag, remove the instruction books from the upper compartment, and remove the antenna from the bottom compartment.

(7) Remove the corrugated paper, moistureproof barrier, and wadding from the antenna.

(8) Inspect the equipment for possible damage incurred during shipment.

(9) Check the contents of the crate against the packing slip.

c. Unpacking Domestic Packing Cases. Radio equipment also may be received in domestic packing cases. To unpack, proceed as follows:

(1) Cut the metal bands.

(2) Open the cartons that protect the equipment; or if heavy wrapping paper has been used, remove it carefully and take out the components. Check the contents of the packing case against the packing slip.

Note. Save the original packing cases and containers for both export and domestic shipments. They can be used again when the equipment is repacked for storage or shipment.

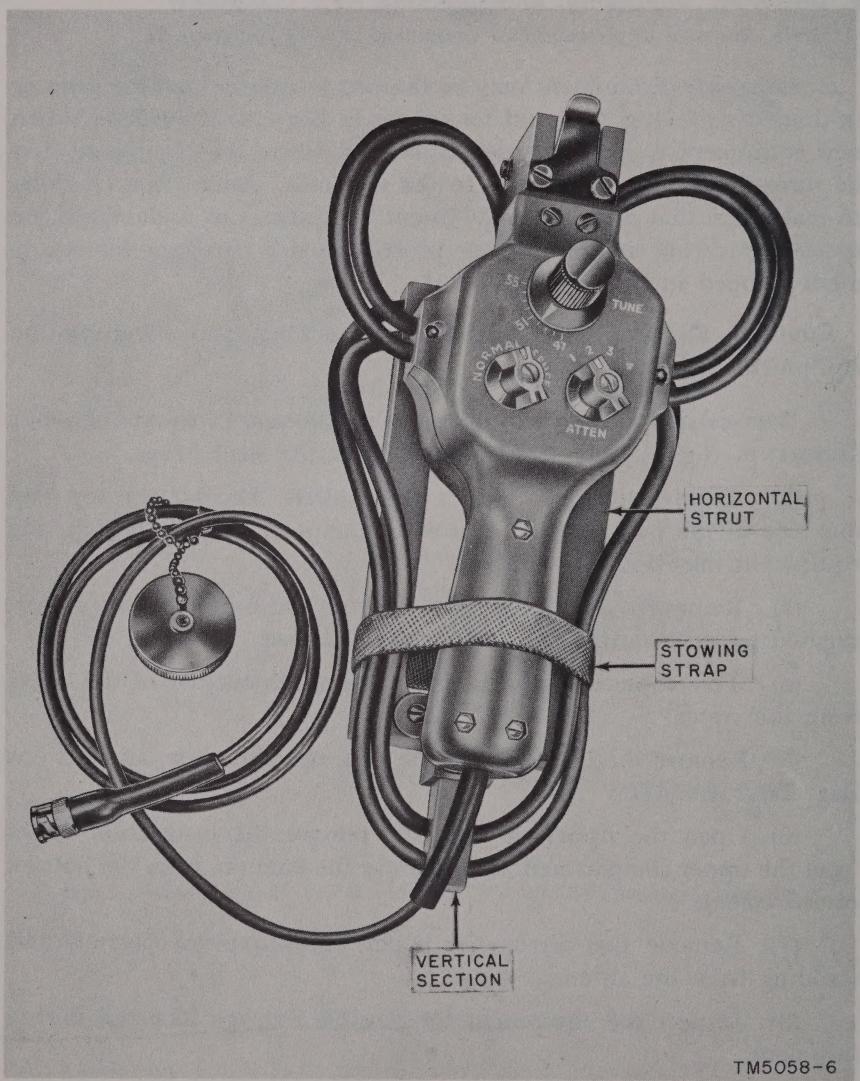

Figure 6. Antenna AT-249/GRD, collapsed.

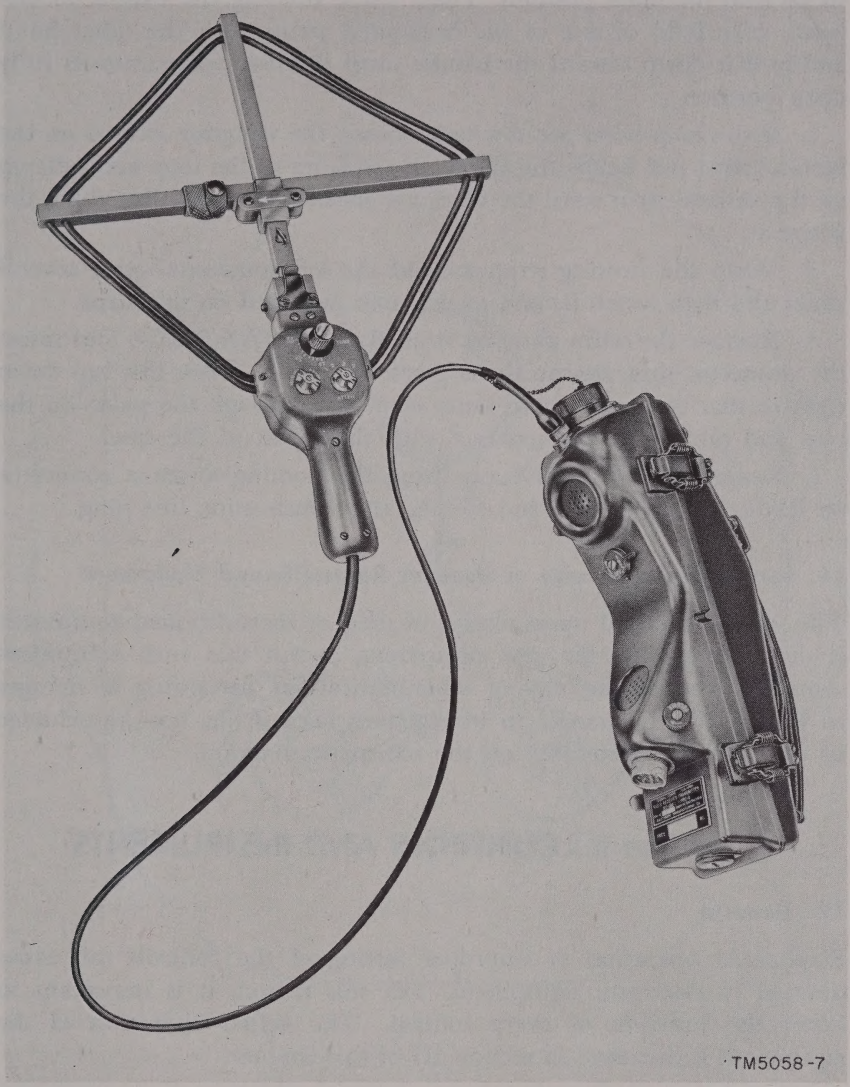

Figure 7. Antenna AT-249/GRD connected to Radio Set AN/PRC-6.

10. Installation

Radio Set AN/PRC-6 is designed for hand-carrying, therefore the installation of Antenna AT-249/GRD consists simply of erecting the collapsed loop (fig. 6) and making the proper connections to Radio Set AN/PRC-6 (fig. 7). The procedure is as follows:

a. Remove the equipment from Bag CW-204/GRD.

b. Erect the loop antenna by releasing the stowing strap and bending the vertical section out straight (away from the handle) until it

snaps into the open position. Then, while holding the handle in one hand, take hold of one of the horizontal struts with the other hand and pull it down toward the handle until the loop snaps into its fully open position.

c. If the loop wires are not taut, loosen the wingnut located on the vertical strut just below the arrow on the front of the loop and pull up on the vertical strut until the wires are sufficiently tight. Retighten the wingnut.

d. Wrap the stowing strap around the left horizontal strut several times and then fasten its end to the snap provided on this strut.

e. Remove the whip antenna from Radio Set AN/PRC-6 and insert the connector shorting-cap in its place. Be sure to screw this cap down tight so that the teeth on its outer edge bite through the paint on the case and make electrical contact with the metal of the case.

f. Remove the protective cap from the homing antenna connector on Radio Set AN/PRC-6 and connect the transmission line plug.

11. Service Upon Receipt of Used or Reconditioned Equipment

The service required upon receipt of used or reconditioned equipment is the same as that for new equipment, except that such equipment should be checked for tags or other indications pertaining to changes in wiring. If any changes in wiring have been made, note the change in this manual, preferably on the schematic diagram.

Section II. CONTROLS AND INSTRUMENTS

12. General

Haphazard operation or improper setting of the controls can cause damage to electronic equipment. For this reason, it is important to know the function of every control. The actual operation of the equipment is discussed in section III of this chapter.

13. Antenna AT-249/GRD Controls

The following table lists the controls and indicates what they do:

Control	Function
TUNE control (C101)	Tunes loop to desired frequency within the range of 47 to 55.4 mc.
NORMAL-SENSE switch (S101)	Selects either NORMAL or SENSE operation of the loop.
ATTEN switch (S102)	Provides a means of controlling the amount of signal output from the loop.

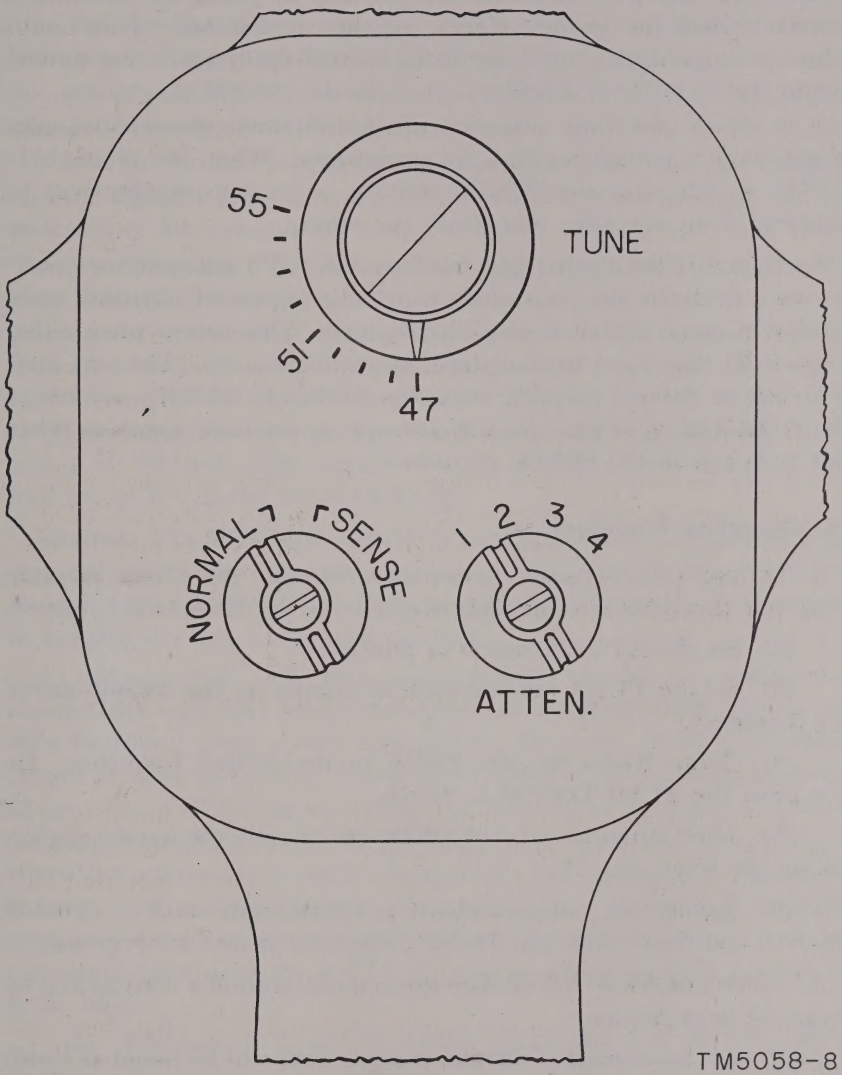

Figure 8. Antenna AT-249/GRD controls.

Section III. OPERATION UNDER USUAL CONDITIONS

14. General

a. In the following paragraphs the terms "maximum position" or "maximum" are used to define the position in which the antenna is oriented when the greatest signal response is obtained. This occurs when the edge of the loop is pointing toward the transmitting station. When the NORMAL-SENSE switch is in the NORMAL position, signals of equal maximum intensity will be obtained when either edge of the loop is pointed toward the transmitter. When the NORMAL-SENSE switch is in the SENSE position, a greater response will be obtained from one edge than from the other.

b. In the following paragraphs the terms "null position" or "null" are used to define the position in which the antenna is oriented when minimum or no signal response is obtained. This occurs when either side of the loop faces toward the transmitting station. The two nulls will only be defined properly when the NORMAL-SENSE switch is in the NORMAL position. Do not attempt to use null operation when this switch is in the SENSE position.

15. Operating Procedure

a. TUNING AND INITIALLY LOCATING A SIGNAL. (1) Check to make sure that the NORMAL-SENSE switch is in the NORMAL position.

(2) Set the ATTEN switch to position 1.

(3) Set the TUNE knob as close as possible to the desired operating frequency.

(4) Tune Radio Set AN/PRC-6 to the desired frequency. Do not press the PUSH-TO-TALK switch.

(5) Hold Antenna AT-249/GRD vertical with the handle slightly above eye level (fig. 1).

(6) Rotate the antenna about a vertical axis until a signal is received and then adjust the TUNE control for maximum response.

b. NULL LOCATION. (1) Rotate the antenna around a vertical axis by means of wrist motion.

(2) As the antenna is rotated, two positions will be found at which the received signal output of the receiver earphone falls off or disappears entirely. These points are the nulls. They occur one-half revolution apart when the plane of the loop is broadside to the direction from which the signal is coming.

c. SENSING. Since there are two nulls, the null indication alone does not provide sufficient information for the operator to determine whether the transmitting source is in front of, or behind the loop.

Therefore, to find the actual direction to the transmitting source, it is necessary to determine the sense of the bearing. The sensing procedure is as follows:

(1) Throw the NORMAL-SENSE switch to SENSE while holding the antenna on one of the nulls.

(2) Rotate the loop about a vertical axis a quarter-turn in one direction and note the strength of the received signal.

(3) Rotate the loop a half-turn from this last position and again note the strength of the received signal.

(4) Orient the loop in the position that produced the strongest received signal. The arrow on the loop frame will now point in the direction of the transmitter.

(5) When the direction of the signal is determined, throw the NORMAL-SENSE switch back to NORMAL and use the null for homing operation, since it gives a sharper and more accurate bearing indication than the maximum positions. In the presence of a strong signal, the null will be quite narrow and rotation of a few degrees will result in sharp variations of the received signal. On a weaker signal, the width of the null may increase to 30° or 40°. The center of this null arc or area is the correct bearing.

Caution: The NORMAL-SENSE switch should be in the SENSE position only when sensing. As soon as sense has been determined, throw the switch back to NORMAL and proceed toward the target transmitter by keeping the loop in the null position.

d. ATTENUATION. (1) Very strong signals may have a tendency to obscure the null and sense indications. In general, such signals will only be found close to the transmitter. However, if the transmitter cannot be seen and a very strong signal tends to obscure the bearings, advance the ATTEN switch to position 2, 3, or 4 as necessary, to reduce the received signal strength to the point where the null becomes clear. When the attenuator is used, it is generally not necessary to retune the antenna after switching to the various positions. However, if the nulls seem very broad or are not evident, readjust the TUNE control for maximum signal with the ATTEN switch in the position in which it is to be used.

(2) Positions 1, 2, and 3 provide increasing and marked differences in attenuation. The position of least attenuation which will permit sense and bearing determination should be used. Operation in attenuator position 4 is not required except in the immediate vicinity of the transmitting station (100-200 yards). Accurate sense indication may be difficult to obtain in this position but this should not present any operating difficulties, since the general direction of travel has been previously established and the null bearing indication should be sufficient to permit finding the transmitter.

e. HOMING. To home on a signal it is only necessary to do the following:

(1) Find the null and take a bearing.

(2) Determine the sense.

(3) Proceed in the direction indicated by the arrow on the loop frame when the loop is in the maximum response sense position.

(4) Once the proper sense has been obtained and the NORMAL-SENSE switch returned to NORMAL the loop must be turned back to the broadside position and the null again obtained. If the null is particularly broad, rotate the loop back and forth a few times. Select the center of the null and proceed on a line through the center of this null until the transmitting station is reached.

(5) As the transmitter is approached, successive bearings can be taken with increased accuracy because of the narrowing null area which results from increasing signal strength.

16. Operating Suggestions

a. Do not modify the components of Antenna AT-249/GRD. The loop and transmission line have been designed to work together. Any change in the length of transmission cable or redesign of the loop may render the equipment inoperative.

b. When finding a null, hold the loop in a vertical position with the handle at, or above, eye level. When sensing, hold the loop as high as possible. In both cases the plane of the loop should be vertical. It is not necessary to hold the loop antenna high continually, particularly when following a well-defined null, but frequent checks should be made to assure the correct path of travel.

c. It is possible that a signal has been bent or reflected, but using the loop to take periodic bearings will lead the operator to the signal source (although not always along the shortest possible path). In wooded areas the signal may become very weak or die away. When this is encountered, follow the predetermined course for a short distance, or seek a relatively open spot and take a bearing.

d. Avoid taking bearings near natural or man-made obstacles. Locations near power or telephone lines, fences, railroad tracks, bridges, cliffs, or buildings distort the wave path and usually cause false bearings or obscure nulls.

e. Always tune for maximum received signal on each operating frequency. Recheck the tuning when in doubt and after changing the attenuator setting.

f. Always check connections for good, clean contact.

g. To conserve batteries, turn off the radio set when not taking a bearing.

Section IV.
OPERATION UNDER UNUSUAL CONDITIONS

17. General

The operation of Radio Set AN/PRC-6 and Antenna AT-249/GRD may be difficult in regions where extreme cold, heat, humidity and moisture, sand conditions, etc., prevail. In the following paragraphs instructions are given on procedures for minimizing the effect of these unusual operating conditions.

18. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather affect the efficient operation of the equipment. Instructions and precautions for operation under such adverse conditions follow:

a. Handle the equipment carefully.

b. Keep the equipment warm and dry.

c. Keep frost or ice from accumulating on the loop frame, since this would prevent the loop from being opened or closed.

d. When equipment that has been exposed to the cold is brought into a warm room, it will start to sweat and will continue to do so until it reaches room temperature. When the equipment has reached room temperature, dry it thoroughly. This condition also arises when equipment warms up during the day after exposure during a cold night.

e. Use any improvised means to protect the dry batteries for the equipment, since they will fail if not protected against the cold. Preheat the batteries. To prevent heat loss, place them in bags lined with kapok, spun glass fiber materials, animal skins, or woolen clothing.

19. Operation in Desert Climates

The main problem that arises with equipment operation in desert areas is the large amount of sand or dust and dirt which enters the moving parts of the equipment. Therefore, the equipment should be stored in dustproof containers when not in use. When equipment is being used, take care to keep it as free from dust and sand as possible. Excessive accumulations of sand, dust, or dirt on the loop frame will prevent the loop from being opened or closed properly.

CHAPTER 3
ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. PREVENTIVE MAINTENANCE SERVICES

20. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that break-downs and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from trouble shooting and repair since its objective is to prevent certain troubles from occurring. See AR 750-5.

21. General Preventive Maintenance Techniques

a. Use a clean, dry, lint-free cloth or a dry brush for cleaning.

(1) If necessary, except for electrical contacts, moisten the cloth or brush with Solvent, dry-cleaning (SD); then wipe the parts dry with a cloth.

(2) Clean electrical contacts with a cloth moistened with carbon tetrachloride; then wipe them dry with a cloth.

b. If available, dry compressed air may be used at a line pressure not exceeding 60 pounds per square inch to remove dust from inaccessible places; be careful, however, or mechanical damage from the air blast may result.

c. For further information on preventive maintenance techniques, refer to TB SIG 178.

22. Performing Preventive Maintenance

The following preventive maintenance operations should be performed by organizational personnel at weekly intervals, unless this interval is reduced by the commanding officer:

Caution: Screws, bolts, and nuts should not be tightened carelessly. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

a. Clean exterior of equipment.

b. Check all controls for normal mechanical operation.

c. Open loop frame and adjust tension of loop wires if necessary.

d. Check all nuts, bolts, and screws, and tighten as necessary.

e. Check the transmission line and loop wires for cracked, cut, or frayed insulation.

23. Weatherproofing

a. GENERAL. Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. TROPICAL MAINTENANCE. A special moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is explained in TB SIG 13 and TB SIG 72.

c. WINTER MAINTENANCE. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained in TB SIG 66 and TB SIG 219.

d. DESERT MAINTENANCE. Special precautions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are explained in TB SIG 75.

Section II. TROUBLE SHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

24. Scope

a. The trouble shooting and repair work that can be performed at the organizational maintenance level (operators and repairmen) is necessarily limited in scope by the tools, test equipment, and replaceable parts issued, and by the existing tactical situation. Accordingly, trouble shooting is based on the performance of the equipment and the use of the senses in determining such troubles as broken parts, cracked insulation, etc.

b. The paragraphs which follow in this section help in determining which parts are at fault.

25. Visual Inspection

a. Failure of this equipment to operate properly usually will be

caused by one or more of the following faults:

(1) Worn, broken, or disconnected transmission line.

(2) Improperly connected connector shorting-cap.

(3) Broken loop wire.

(4) Broken loop frame member.

(5) Connector UG-88/U at end of transmission line making improper contact (fig. 3).

b. When failure is encountered and the cause is not immediately apparent, check as many of the above items as is practicable before starting a detailed examination of the parts of the equipment. If possible, obtain information from the operator of the equipment regarding performance at the time trouble occurred.

26. Trouble Shooting by Using Equipment Performance Checklist

a. GENERAL. The equipment performance checklist (par. 27) will help the operator to locate trouble in the equipment. This list gives the item to be checked, the conditions under which the item is checked, the normal indications and tolerances of correct operation, and the corrective measures the operator can take. To use this list, follow the items in numerical sequence.

b. ACTION OR CONDITION. For some items, the information given in the action or condition column consists of various switch or control settings under which the item is to be checked. For other items it represents an action that must be taken to check the normal indication given in the normal indications column.

c. NORMAL INDICATIONS. The normal indications listed include the visible and audible signs that the operator should perceive when he checks the items. If the indications are not normal, the operator should apply the recommended corrective measures.

d. CORRECTIVE MEASURES. The corrective measures listed are those the operator can make without turning in the equipment for repairs. A reference in the table to chapter 5 indicates that the trouble cannot be corrected during operation and that trouble shooting by an experienced repairman is necessary. If the antenna is completely inoperative or if the recommended corrective measures do not yield results, trouble shooting is necessary. However, if the tactical situation requires that operation of the antenna be maintained and if the antenna is not completely inoperative, the operator must maintain it in operation as long as it is possible to do so.

27. Equipment Performance Checklist

Note. The following chart assumes that the Radio Set AN/PRC-6 used is known to be in good condition.

Item No.	Item	Action or condition	Normal indications	Corrective measures
1	Antenna	Pick up signal and rotate antenna with NORMAL-SENSE switch at NORMAL.	Two distinct signal nulls one-half revolution apart and two broad maximums one-half revolution apart.	Change location to get away from obstacles. If this does not correct trouble refer to chapter 5.
2	Antenna	Repeat item 1 above with NORMAL-SENSE switch at SENSE.	One broad null and one broad maximum one-half turn apart.	See item 1 above.
3	TUNE control	Pick up signal and rotate TUNE control through its range.	Signal strength should be maximum when TUNE control indicates the approximate frequency of the signal and should fall off on either side of this point. Tune control should not cause any noise in receiver while it is being rotated.	Refer to chapter 5.
4	ATTEN control	Pick up signal with ATTEN control at 1, and then rotate it to positions 2, 3, and 4.	Received signal strength should decrease with each advance in ATTEN control setting.	Refer to chapter 5.

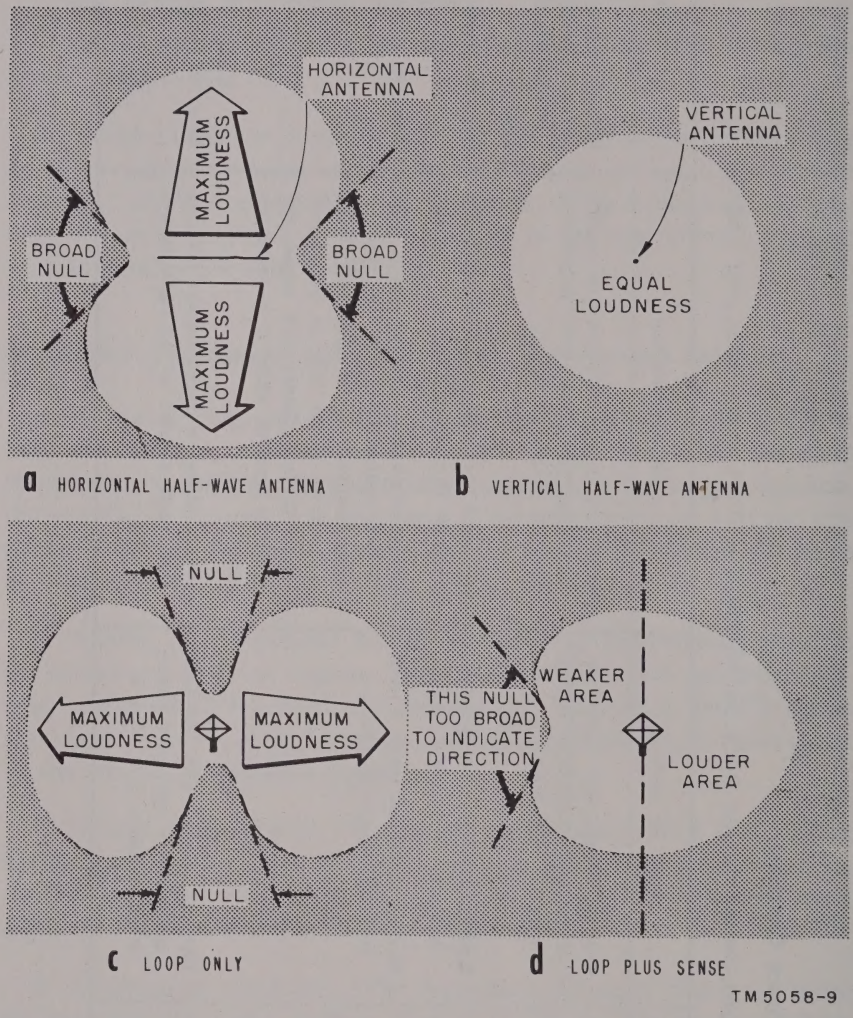

Figure 9. Antenna field strength patterns.

CHAPTER 4
THEORY

28. Antennas

a. GENERAL. During transmission, an r-f (radio-frequency) current in a conductor produces an electrical energy field which is radiated into space. This field consists of electrostatic and electromagnetic fields which are at right angles to each other. The plane parallel to the mutually perpendicular lines of electrostatic and electromagnetic flux is called the *wave front*. The wave travels in a direction at right angles to the wave front.

b. RECEIVING ANTENNAS. (1) If the radiated electromagnetic field cuts a conductor, a voltage will be induced in that conductor. The resulting current varies in accordance with the variations of the electromagnetic field. Thus a variation of the current in a radiating antenna causes a similar varying current in a conductor at a distant location. Any intelligence being produced as current in a transmitting antenna, will be reproduced as current in any receiving antenna.

(2) Antennas receive more energy in certain positions than they do in other positions. This directivity is due to the fact that the received energy depends upon the amount of the radiated field which is cut by the antenna. A horizontal antenna will receive maximum energy when its vertical plane is parallel to the plane of the wave front, since maximum interception occurs in this position. A vertical antenna will have constant reception, since the amount of the radio field it will intercept remains constant regardless of its vertical plane position. Typical field strength patterns for vertical and horizontal antennas are illustrated in figure 9a and b.

29. Direction Finder Antennas

a. GENERAL. Since the fundamental half-wave antenna possesses directional characteristics, it is possible to use this antenna to determine the direction from which a radio signal is being received. This can be accomplished by rotating the antenna about an axis that is perpendicular to the plane in which the directivity exists and observing the changes in received signal strength. However, as can be seen from the radiation pattern at a in figure 9, the directional pattern produced by a simple half-wave dipole contains only broad maxima and minima with only a small difference existing between the maximum and minimum points. In order to take a reasonably accurate bearing on

the direction of a received signal it is necessary to have an antenna that possesses relatively sharp maximum (or minimum) response points with fairly large differences in sensitivity existing between the maximums and minimums. A special antenna known as the *loop* antenna has therefore been evolved for direction finder usage.

b. Loop Antennas. A loop antenna consists essentially of a large diameter coil and produces a directional response pattern similar to a figure eight, containing two broad maximums and two relatively sharp minimums or nulls (fig. 9c). This pattern is oriented with respect to the loop so that maximum response is obtained when either of the edges of the loop is pointed toward the transmitter, and minimum response is obtained when the plane of the loop is broadside to the transmitter. The points of minimum response (the nulls) are used to indicate direction because they are more sharply defined than the points of maximum response and therefore make it easier to take an accurate bearing. This response pattern is obtained as follows:

(1) Consider the loop to be divided vertically into two halves. Then, a wave front approaching broadside to the plane of the loop will cut both halves of the loop at the same time. This causes equal voltages to be induced in the two halves of the loop and these two voltages will be in phase with each other, since both halves of the loop are cut by the wave front at the same time. Since the two voltages tend to drive current around the loop in opposite directions, they cancel each other, producing a net loop current of zero and hence no received signal output.

(2) When the loop is rotated so that the plane of the loop points toward the transmitter, an approaching wave front will cut one side of the loop before it cuts the other. Here again, equal voltages are induced in the two halves of the loop; however, a phase difference exists between the two voltages because the wave front cut one half before it cut the other. This phase difference prevents the two voltages from completely cancelling each other, resulting in a small net loop voltage and hence a received signal output. Note that the net loop voltage is approximately 90° out of phase with the individual induced voltages and has a polarity that depends upon the direction of travel of the radio wave.

(3) If the radio wave arrives in direction 1 (fig. 10) it will induce a voltage E1 in one half of the loop and E2 in the other half. E1 and E2 are almost parallel with each other, but they are drawn at a large angle for purposes of explanation. The net loop voltage, E1-E2, is approximately 90° out of phase with E1 and E2.

(4) Similarly, if the radio wave arrives in direction 3, the net loop voltage is E2-E1 and is 180° out of phase with E1-E2. These directions are important since they will be used in explaining sense operation.

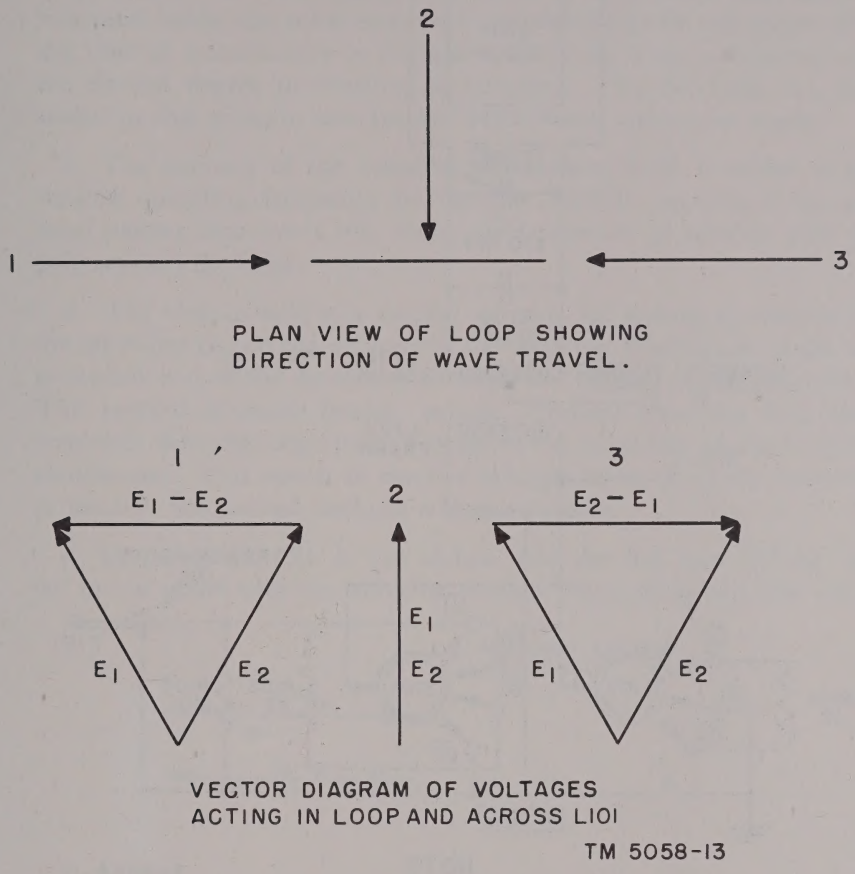

Figure 10. Vector representation of induced and resulting loop antenna voltages.

(5) If the radio wave arrives in direction 2, the voltages E1 and E2 are equal and in phase. Their net difference is then zero and there is no net loop current.

c. Sense Antennas. (1) Since a simple loop antenna possesses two identical nulls 180° apart, it leaves a 180° uncertainty as to the direction of the transmitter; that is, the transmitter may be either in front of, or behind the loop. The sense of the bearing can be determined by introducing a small voltage derived from a vertical (sense) antenna. The resulting pattern of the combined loop and vertical antenna, when the correct amount of vertical antenna voltage is used, is a heart-shaped or cardioid pattern as shown at d in figure 9. This will be explained later.

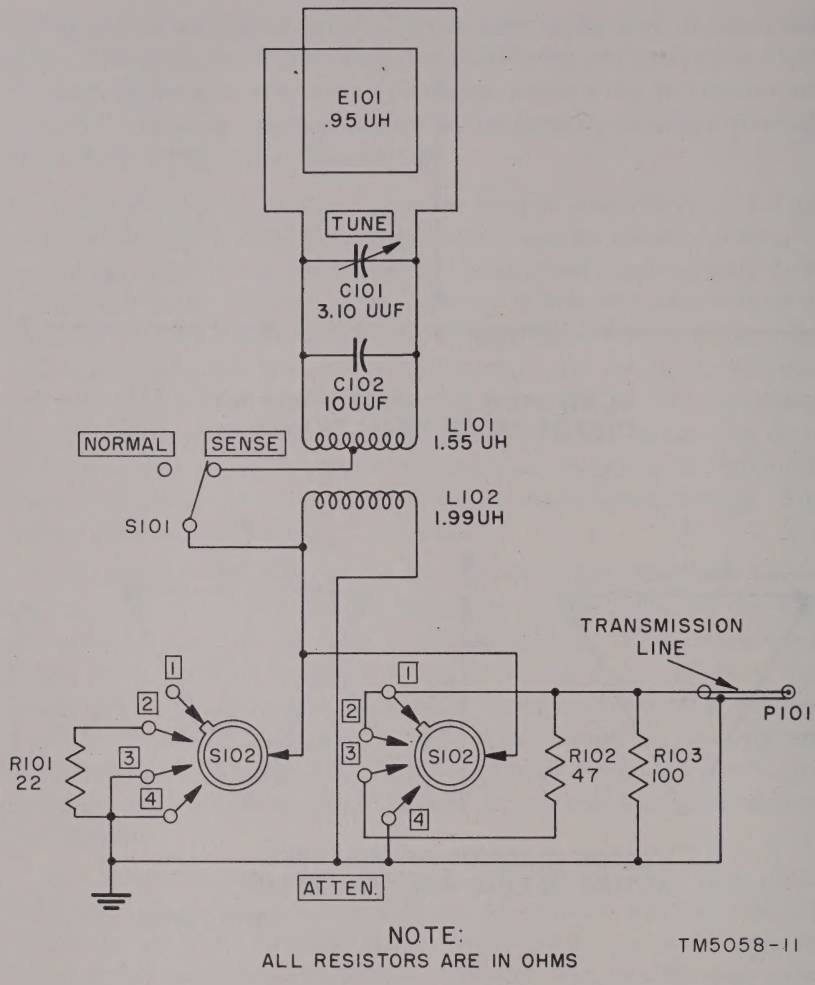

Figure 11. Antenna AT-249/GRD, schematic diagram.

30. Antenna AT-249/GRD (fig. 11)

a. The loop is diamond-shaped. It is approximately 10 inches long on a side and consists of a single turn of two parallel, insulated conductors spaced 1/8 inch apart. A coupling transformer having an off-center-tapped primary is connected across the terminals of the loop and provides an inductive coupling between the loop and the transmission line.

b. The bearing obtained with a loop antenna will be erroneous unless the loop is carefully balanced electrostatically with respect to ground. This is because if the loop is not so balanced, there will be a

residual antenna effect that distorts the directional pattern of the loop. Therefore, the coupling transformer is constructed with one coil mounted inside the other and their relative positions are adjusted at the time of manufacture to the point where the loop is balanced and the desired degree of coupling is obtained. The two coils are then sealed in this position and further adjustments cannot be made.

c. The primary of the coupling transformer L101 is tuned to the desired operating frequency by variable TUNE capacitor C101 and fixed padder capacitor C102, which are connected in parallel with the primary and the loop.

d. The loop is used as a vertical antenna for sensing by connecting the off-center tap on the primary of the coupling transformer to the ungrounded end of the secondary through the NORMAL-SENSE switch. The vertical antenna (sense) voltage obtained from the loop then combines with the loop circuit voltage in the secondary of the coupling transformer. This results in the two voltages being properly combined to produce the desired cardioid response pattern.

e. In paragraph 29*b* it was shown that the net loop voltage was 90° out of phase with the inducing voltage. Since there is a 180° phase

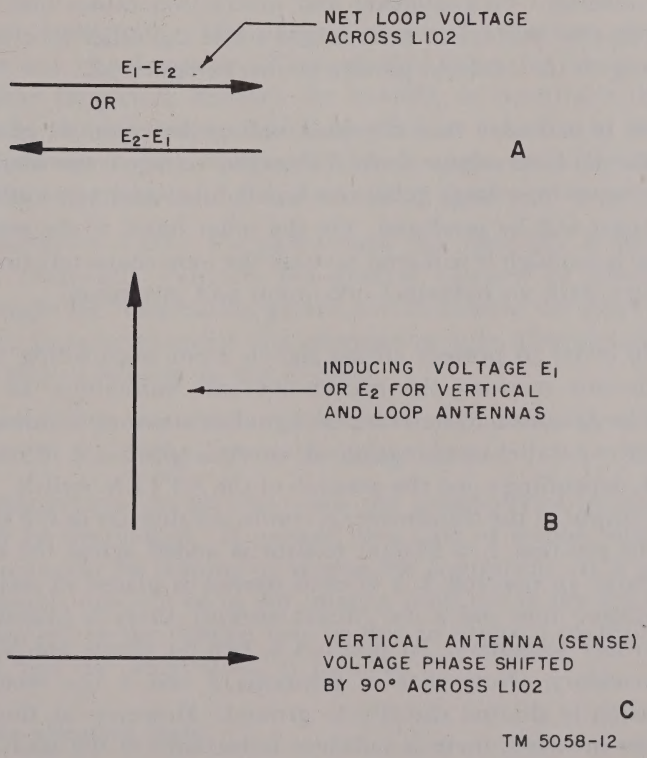

Figure 12. Phase relationship of voltages across L102.

shift across a transformer, the vector direction of the voltage across the secondary of L102 is as shown in figure 12A. The inducing voltage E1 or E2 is indicated in figure 12B. It now remains to determine the sense voltage.

f. In the SENSE position, the loop is converted to a vertical antenna in series with the secondary L101 of the transformer. At resonance, the entire circuit may be considered purely resistive, since the resistive impedance presented by the tuned primary is so much greater than the inductive reactance of the secondary L102. Therefore, the current and voltage in the circuit are in phase with each other. However, the voltage across L102 leads the current through L102 by 90° since L102 is practically a pure inductance. Therefore the sense voltage across L102 leads the antenna voltage by 90° (fig. 12C).

g. Note that the net loop voltage across L102 (fig. 12A) either aids or bucks the sense voltage (fig. 12C). If the loop is so positioned that its arrow (fig. 3) points toward the transmitter, the net loop voltage will add to the sense voltage. If the transmitter now is placed in the opposite direction and the loop retained in the same position as before, the net loop voltage will buck the sense voltage. The sense voltage never reverses. This addition and subtraction causes one lobe of the loop response pattern to be enlarged while the other lobe is decreased, resulting in the cardioid pattern shown in figure 9d.

h. It is necessary that the sense voltage be equal to or slightly less than the net loop voltage since, if the sense voltage is too small, a pattern consisting of one large lobe, one small lobe, and two nulls less than 180° apart will be produced. On the other hand, if the sense antenna voltage is too high it will tend to mask the loop characteristics producing a pattern with an indistinct maximum and minimum.

i. In order to prevent strong signals from overloading the receiver and thereby masking the maximums and minimums, an attenuator circuit is provided. The received signal is attenuated through the use of a series-parallel combination of resistors which are in or out of the circuit, depending upon the position of the ATTEN. switch. In position 1, the output of the transformer is connected directly to the transmission line. In position 2, a 22-ohm resistor is added across the transformer secondary. In position 3, a 47-ohm resistor is placed in series with the transmission line and a d-c (direct-current) short is placed across the transformer secondary. In position 4, two d-c shorts are placed across the secondary. Note that in positions 3 and 4 the received signal is apparently shorted directly to ground. However, at the signal frequencies involved, there is sufficient inductance in the leads to prevent the signal from being directly shorted to ground.

CHAPTER 5
FIELD MAINTENANCE INSTRUCTIONS

Section I.
TROUBLE SHOOTING AT FIELD MAINTENANCE LEVEL

31. Trouble-shooting Procedures

The first step in servicing defective radio equipment is to sectionalize the fault to the *circuit* responsible for the abnormal operation. The second step is to localize the fault. Localization means tracing the fault to the defective component responsible for the abnormal condition. Some faults often can be located by sight, smell, and hearing. Others, however, must be localized by checking resistance measurements. The tests listed below aid in isolating the source of trouble. To be effective the procedure should be followed in the order given. Remember that servicing procedure should cause no further damage to the equipment. The service procedure is summarized as follows:

a. VISUAL INSPECTION. The purpose of visual inspection (par. 25) is to locate any visual trouble. Through this inspection alone, the repairman may frequently discover the trouble, or determine the area in which the trouble exists. This inspection is valuable in avoiding additional damage to the equipment, which might occur through improper servicing methods, and in forestalling future failures.

b. OPERATIONAL TEST. The operational test (par. 27) is important because it frequently indicates the general location of trouble. In many instances the information gained will determine the exact nature of the fault. In order to utilize this information fully, all symptoms must be interpreted in relation to one another.

c. TROUBLE-SHOOTING CHART. The trouble symptoms listed in this chart (par. 37) will aid greatly in localizing trouble.

d. INTERMITTENTS. In all these tests the possibility of intermittents should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the equipment. It is possible that the trouble may not be in the antenna itself but in the installation or the radio set, or the trouble may be due to external conditions. In this event, test the installation, if possible.

32. Trouble-shooting Data

Take advantage of the material supplied in this manual. It will help

in the rapid location of faults. Consult the following trouble-shooting data:

Fig. or par. No.	Description
Fig. 11	Antenna AT-249/GRD, schematic diagram.
Fig. 13	Antenna AT-249/GRD, interior view of housing.
Par. 35	Resistance measurements.

33. Test Equipment Required for Trouble Shooting

The test equipment required for trouble shooting Antenna AT-249/GRD is listed below. The technical manuals associated with the test equipment are also listed.

Test equipment	Technical manual
Test Units I-176, I-176-A, and I-176-B	TM 11-2626
Multimeter TS-352/U, or equal	TM 11-5527

34. General Precautions

Whenever the antenna is serviced, observe the following precautions very carefully:

a. Before a part is unsoldered, note the position of the leads. If the part, such as a transformer, has a number of connections, tag each of the leads to it.

b. Be careful not to damage other leads by pulling or pushing them out of the way.

c. Do not allow drops of solder to fall into the unit, since they may cause short circuits.

d. A carelessly soldered connection may cause a new fault. It is very important to make well-soldered joints, since a poorly soldered joint is one of the most difficult faults to find.

e. When a part is replaced in r-f circuits, it must be placed exactly as the original one was. A part which has the same electrical value but different physical size may cause trouble in h-f (high-frequency) circuits. Give particular attention to proper grounding when replacing a part. Use the same ground as the original wiring. Failure to observe these precautions may result in obscure nulls, erroneous nulls, or complete loss of nulls.

35. Resistance Measurements

The condition of all electrical parts in the antenna can be checked with an ohmmeter as follows:

a. The condition of the transformer secondary, attenuator, and transmission line can be checked without disassembling the antenna by connecting an ohmmeter between the center conductor and the shell of the plug on the end of the transmission cable and then rotating the ATTEN control through its four positions. Positions 1 and 2 should give zero readings. Position 3 should give a reading of 32 ohms and position 4 should give a reading of 100 ohms.

b. To check the loop, the transformer primary, and R103 it is necessary to disassemble the antenna and measure the parts directly. The loop and coupling transformer primary should show zero resistance and R103 should be 22 ohms.

36. Operational Tests

If the antenna is connected to its associated components as in normal operation, operate the equipment as described in the equipment performance checklist (par. 27). This checklist is important because it frequently indicates the general location of trouble.

37. Trouble-shooting Chart

The following chart is supplied as an aid in locating trouble. This chart lists the symptoms which the repairman observes, either visually or audibly, while making a few simple tests.

Symptom	Probable trouble	Correction
1. Rotation of TUNE control causes noise in receiver.	1. Variable capacitor plates bent (rubbing on each other) or noisy shaft bearing.	1. Repair or replace as necessary.
2. Signals cannot be picked up with loop antenna and radio set functions normally with whip antenna.	2. Shorted transmission line.	2. Measure resistance from center conductor to shell on plug at end of transmission line with ATTEN switch at 4. The correct reading is 100 ohms.
3. Attenuator operation erratic.	3. Dirty switch contacts or broken detent mechanism.	3. Clear contacts or replace switch.

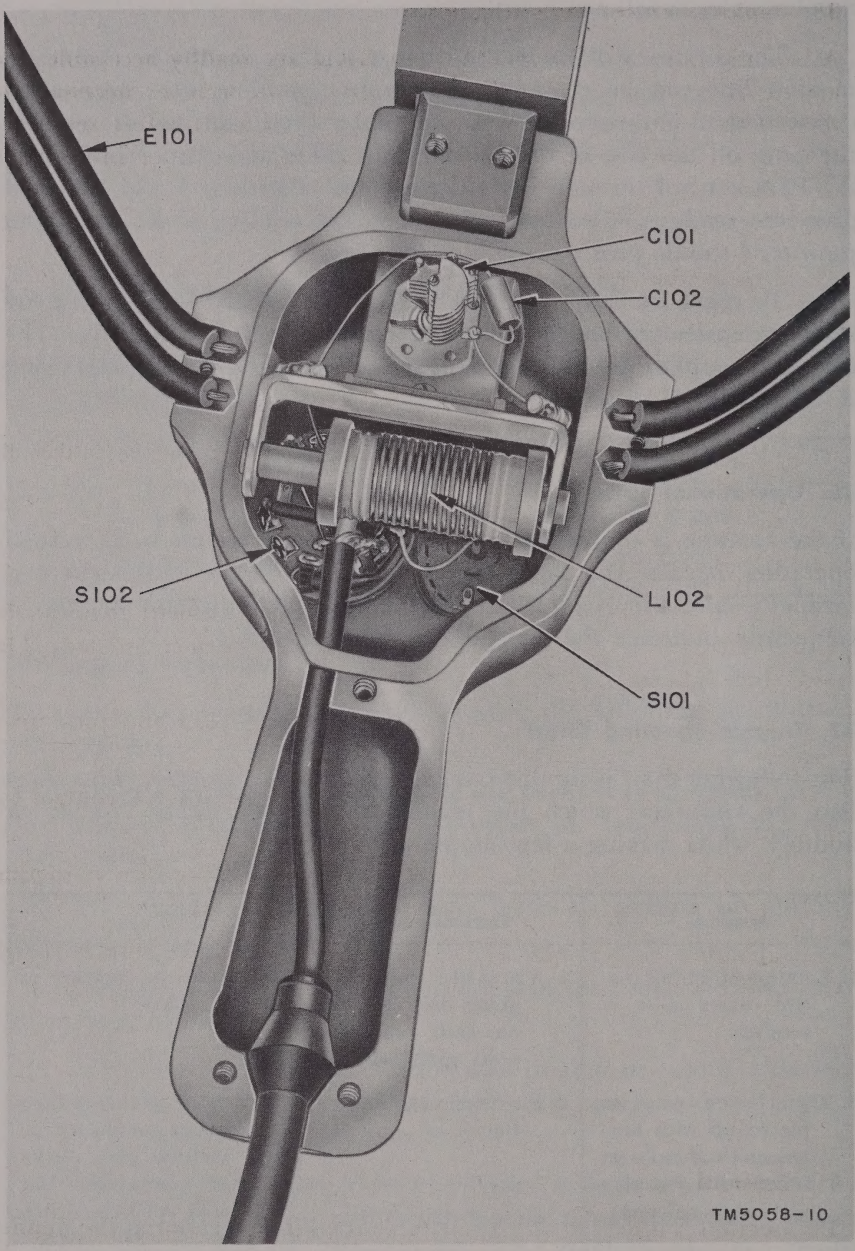

Figure 13. Antenna AT-249/GRD, interior view of housing.

Section II. REPAIRS

38. Replacement of Parts (fig. 13)

All of the parts in Antenna AT-249/GRD are readily accessible and are easily replaced if found to be faulty. If it becomes necessary to remove the coupling transformer, tag each of its leads before removing it to avoid making wiring mistakes when replacing it or installing a new one.

39. Disassembly Procedure

The antenna can be disassembled as follows:

a. Remove the seven screws in the housing and handle.

b. Pull off the back half of the housing and handle.

Note. All parts are now exposed and the methods to be used for further disassembly will be obvious upon inspection.

40. Adjustment of TUNE Control

Calibration of the TUNE control is the only adjustment that can be made. This should be done after all repairs have been completed. The procedure is as follows:

a. Connect the antenna to a Radio Set AN/PRC-6 and pick up a signal.

b. With the ATTEN switch in position 1, adjust TUNE control for maximum signal.

c. Loosen the setscrew in the TUNE knob and position it so that it indicates the frequency to which the radio set is tuned.

d. Tighten the setscrew and recheck tuning to make sure it is still set at the maximum signal position.

Section III. FINAL TESTING

41. General

This section is intended as a guide to be used in determining the quality of a repaired Antenna AT-249/GRD. The minimum test requirements outlined in paragraphs 42 through 48 may be performed by maintenance personnel with adequate test equipment and the necessary skills. Repaired equipment meeting these requirements will furnish uniformly satisfactory operation.

42. Test Equipment Required for Final Testing

The instruments needed for testing the repaired equipment are listed below:

a. Signal generator with metered output, covering the frequency range of 47-55.4 mc, capable of being frequency-modulated (25-kc (kilocycle) deviation) at 1,000 cycles, and equipped with both an output cable and a rod antenna.

b. A screen room containing an overhead transmission line.

c. A turntable upon which the antenna can be mounted, capable of 360° rotation and with an azimuth scale calibrated in 1° divisions that are accurate to within ±.5°.

d. Radio Set AN/PRC-6.

e. An electronic multimeter.

f. Three Crystal Units CR-23/U to provide operation of Radio Set AN/PRC-6 on frequencies of 47.0, 51.2, and 55.4 mc.

43. Preparation

a. Take the turntable, antenna, and radio set into the screen room.

b. Connect the output of the signal generator to the overhead transmission line.

c. Mount Antenna AT-249/GRD on the turntable.

d. Place the antenna and turntable under the overhead transmission line so that the antenna is accurately centered with respect to the line and is at least 1 foot below it.

e. Connect the electronic multimeter to the grid of the limiter in the radio set by connecting it between pin 3 of test jack J2 and ground in Radio Set AN/PRC-6.

f. Connect Antenna AT-249/GRD to Radio Set AN/PRC-6 (par. 10).

Note. Locate all test and measuring equipment outside of the screen room and stay out of the screen room while taking the required measurements.

44. Frequency Coverage Test

a. Set up Radio Set AN/PRC-6 for operation on 47.0 mc.

b. Turn on all of the equipment. Set TUNE control to 47, set NORMAL-SENSE switch to NORMAL, and set ATTEN control to 1.

c. Set the signal generator to 47 mc and increase its output level until the electronic multimeter reading shows an increase.

d. Adjust the signal generator frequency for a maximum reading on the electronic multimeter.

e. Set the signal generator output level so that the electronic multimeter reads approximately 2 volts.

f. Check the ability of the TUNE control to resonate the antenna by rotating it through its range and looking for a point which produces a maximum reading on the electronic multimeter.

g. Repeat the procedure described in subparagraphs *a* through *f* above at 51.2 mc and 55.4 mc.

h. For the antenna to pass this test satisfactorily, the maximum reading on the electronic multimeter described in subparagraph *f* above must occur for each of the three frequencies, and the TUNE dial readings at the maximum point must be an approximate indication of the frequency.

45. Null Ratio and Bearing Accuracy Test

a. Set up Radio Set AN/PRC-6 for operation on 47.0 mc.

b. Turn on all the equipment. Set the NORMAL-SENSE switch at NORMAL, set the ATTEN control to 1, and adjust the TUNE control for a maximum reading on the electronic multimeter.

c. Rotate the antenna on the turntable to the point that gives the highest reading on the electronic multimeter.

d. Adjust the signal generator output to obtain a reading of 2 volts on the multimeter and then record the signal generator output level.

e. Rotate the antenna to the point of minimum pick-up, increasing the signal generator output as necessary to keep the receiver noise voltage from obscuring the null reading on the multimeter.

f. With the antenna set at the minimum pick-up point, adjust the signal generator output to produce a multimeter reading of 2 volts, and record the signal generator output level and the azimuth scale reading.

g. Rotate the antenna approximately 180° and accurately position it at the other minimum pick-up point.

h. Adjust the output of the signal generator to produce an electronic multimeter reading of 2 volts and record the signal generator output level and the azimuth scale reading.

i. Repeat the procedure described in subparagraphs *a* through *h* above at 51.2 mc and at 55.4 mc.

j. Take the signal generator output level reading obtained in subparagraph *f* or *h* above, whichever is higher, for each of the three frequencies and compare it with the reading recorded for the same frequency in subparagraph *d* above. To pass the null ratio part of the test, the two readings compared for each frequency must show a voltage ratio of at least 25 db.

k. Compare the azimuth scale readings obtained for each frequency in subparagraphs *f* and *h* above. To pass the bearing accuracy part of the test, the two readings for each frequency must differ by 180°, ±3°.

46. Attenuator Test

a. Set up the equipment for operation on 55.4 mc.

b. Adjust the TUNE control for a maximum reading on the electronic multimeter with the ATTEN control at position 1.

c. Orient the antenna for maximum meter reading.

d. Adjust the output of the signal generator to obtain an electronic multimeter reading of 2 volts and record the signal generator output level.

e. Set the ATTEN control to position 2 and repeat subparagraph *d* above.

f. Repeat subparagraph *d* above for ATTEN control positions 3 and 4.

g. The signal generator output level readings must be approximately 4 db, 14 db, and 27 db higher for ATTEN control positions 2, 3, and 4, respectively than that obtained for position 1.

47. Sensitivity Test

Note. This test is to be performed in a cleared area with the antenna and signal source at least two wavelengths apart.

a. Disconnect Antenna AT-249/GRD and mount the whip antenna on the radio set.

b. Set up the equipment for operation on 47.0 mc, modulate the signal generator at 1,000 cycles with a deviation of 25 kc, extend the rod on the signal generator and connect the multimeter across the earphone in the radio set.

c. Adjust the signal generator output to produce a multimeter reading of 2 volts and record the signal generator output level.

d. Disconnect the whip antenna and connect Antenna AT-249/GRD to the radio set.

e. Orient the antenna and adjust the TUNE control for maximum reading on the electronic multimeter, with the NORMAL-SENSE switch at NORMAL and the ATTEN control at 1. Do not disturb the signal generator output level adjustment.

f. Record the electronic multimeter reading.

g. Repeat the procedure described in subparagraphs *a* through *f* above at 52.1 mc and at 55.4 mc.

h. The readings obtained in subparagraph (6) above must not be less than 1.6 volts for each frequency.

48. Sense Tests

a. GENERAL. This test is to be performed in a cleared area, with the antenna and signal source located approximately 100 feet apart.

b. TEST PROCEDURE. (1) Extend the rod antenna on the signal generator.

(2) Set up the equipment for operation on 47.0 mc, with Antenna AT-249/GRD connected to Radio Set AN/PRC-6 and the multimeter connected to indicate limiter grid voltage (pin 3 of J2).

(3) Set the NORMAL-SENSE switch at SENSE, and set the ATTEN control at 1.

(4) With the antenna and signal generator approximately 100 feet apart in a cleared area, rotate the antenna to the point of maximum pick-up (maximum reading on the multimeter), with the arrows on the loop frame pointing toward the signal generator.

(5) Adjust the output of the signal generator to produce a multimeter reading of 2 volts, and record the signal generator output level.

(6) Rotate the antenna approximately 180° to the point of minimum pick-up.

(7) Readjust the signal generator output to produce an electronic multimeter reading of 2 volts, and record the signal generator output level.

(8) Repeat the procedure described in subparagraphs (1) through (7) above at 51.2 mc and at 55.4 mc.

(9) Compare the signal generator output levels recorded in subparagraphs (5) and (7) above for each operating frequency. The values recorded in subparagraph (7) must be at least 10 db higher than those recorded in subparagraph (5).

CHAPTER 6
SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

49. Disassembly

If Antenna AT-249/GRD is connected to a radio set, disconnect it, collapse the loop, and use the strap on the loop frame to hold the loop in the collapsed position.

50. Repacking for Shipment or Limited Storage

To repack the equipment for shipment or limited storage, simply reverse the procedure for uncrating and unpacking given in paragraph 9.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

51. General

The demolition procedures outlined in paragraph 52 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon order of the commander.

52. Methods of Destruction

a. SMASH. Smash the loop frame and housing, using sledges, axes, handaxes, hammers, or heavy tools.

b. CUT. Cut cords and wiring, using axes, handaxes, or machetes.

c. BURN. Burn cords, resistors, coils, wiring, and technical manuals, using gasoline, kerosene, oil, flame throwers, or incendiary grenades.

d. EXPLOSIVES. If explosives are necessary, use firearms, grenades, or TNT.

e. DISPOSAL. Bury or scatter the destroyed parts in slit trenches, fox holes, or other holes, or throw them into streams.

DESTROY EVERYTHING

APPENDIX I

REFERENCES

Note. For availability of items listed, check SR 310-20-3 and SR 310-20-4. Check Department of the Army Supply Catalog SIG 1 for Signal Corps supply catalog pamphlets.

1. Army Regulations

AR 380-5	Safeguarding Military Information.
AR 750-5	Maintenance of Supplies and Equipment (Maintenance Responsibilities and Shop Operation).

2. Supply Publications

SIG 1	Introduction and Index.
SIG 3	List of Items for Troop Issue.
SIG 5	Stock List of All Items.
SIG 6	Sets of Equipment.
SIG 7&8	Organizational Maintenance Allowances and Field and Depot Maintenance Stockage Guide.
SB 11-47	Preparation and Submission of Requisitions for Signal Corps Supplies.
SB 11-76	Signal Corps Kit and Materials for Moisture- and Fungi-Resistant Treatment.

3. Publications on Auxiliary Equipment and Test Equipment

TM 11-296	Radio Set AN/PRC-6 (Operators Manual).
TM 11-303	Test Sets I-56-C, I-56-D, I-56-H, and I-56-J.
TM 11-307	Signal Generators I-72-G, H, J, K, and L.
TM 11-321	Test Set I-56-E.
TM 11-2613	Voltohmmeter I-166.
TM 11-5527	Multimeter TS-352U.

4. Painting, Preserving, and Lubrication

TB SIG 13	Moistureproofing and Fungiproofing Signal Corps Equipment.
TM 9-2851	Painting Instructions for Field Use.

5. Camouflage

FM 5-20	Camouflage, Basic Principles.

6. Decontamination

TM 3-220	Decontamination.

7. Demolition

FM 5-25	Explosives and Demolitions.

8. Other Publications

FM 24-18	Field Radio Techniques.
FM 72-20	Jungle Warfare.
SR 310-20-3	Index of Training Publications (Field Manuals, Training Circulars, Firing Tables and Charts, Army Training Programs, Mobilization Training Programs, Graphic Training Aids, Joint Army-Navy-Air Force Publications, and Combined Communications Board Publications).
SR 310-20-4	Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Tables of Organization, and Tables of Equipment.
SR 700-45-5	Unsatisfactory Equipment Report (Reports Control Symbol CSGLD-247).
SR 745-45-5 NAV DEPT SERIAL 85P00 AFR 71-4	Report of Damaged or Improper Shipment (Reports Control Symbols CSGLD-66 (Army), SandA-70-6 (Navy), and AF-MC-U2 (Air Force)).
TB SIG 4	Methods for Improving the Effectiveness of Jungle Radio Communication.
TB SIG 5	Defense Against Radio Jamming.
TB SIG 25	Preventive Maintenance of Power Cords.
TB SIG 66	Winter Maintenance of Signal Equipment.
TB SIG 72	Tropical Maintenance of Ground Signal Equipment.
TB SIG 75	Desert Maintenance of Ground Signal Equipment.
TB SIG 123	Preventive Maintenance Practices for Ground Signal Equipment.

TB SIG 178	Preventive Maintenance Guide for Radio Communication Equipment.
TB SIG 219	Operation of Signal Equipment at Low Temperatures.
TB SIG 223	Field Expedients for Wire and Radio.
TB 11-499-( )[1]	Basic Radio Propagation Predictions.
TM 11-314	Antennas and Antenna Systems.

9. Abbreviations

db	decibels
d-c	direct-current
h-f	high-frequency
kc	kilocycle
mc	megacycle
r-f	radio frequency

10. Glossary

For an explanation of the terms used in this manual, refer to TM 11-455.

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[1] A new TB in this series is issued monthly which gives propagation predictions three months in advance.

APPENDIX II

IDENTIFICATION TABLE OF PARTS

1. Requisitioning Parts

The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as a specific T/O&E, T/A, SIG 7-8-10, list of allowances of expendable material, or other authorized supply basis. The Department of the Army Supply Catalog applicable to the equipment covered in this manual is SIG 7&8-AT-249/GRD. For an index of available supply catalogs in the Signal portion of the Department of the Army Supply Catalog, see the latest issue of SIG 1, Introduction and Index.

2. Identification Table of Parts for Antenna AT-249/GRD

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
E102	ANTENNA SUBASSEMBLY: 2 5/16" lg x 1 7/8" wd x 3" d; one 5/32" dia mtg hole; Raytheon part/dwg #YB 1747-5001.	R-f tuning unit.	2A88A-145
O109	ARM: irregular shape; 6 7/8" lg x 1 1/8" wd x .630" thk o/a dimen; mts w/.257" dia. hole on end; special features includes two .266" dia holes 1/2" c to c on end; support arm for loop antenna; Raytheon part/dwg #YC 1747-1027G1.	Antenna cable support.	2A300.9
O111	ARM: irregular shape; 6 7/8" lg x 1 1/8" wd x .630" thk o/a dimen; mts w/.257" dia holes on end; special features includes two .266" dia holes 1/2" c to c one end, and one .144" dia hole 3/8" d, 2 5/16" from other end; support arm for loop antenna; Raytheon part/dwg #YC 1747-1027G2.	Antenna cable support.	2A300.10
A104	BRACKET: irregular shape; 1 7/8" lg x 2 3/8" wd x 2 1/8" d o/a dimen; mts w/one 5/32" dia hole; special features includes two .251" dia holes and 2 cutouts; used to mt variable condenser and coil Raytheon part/dwg #YB 1747-1014.	Mounting for C101, L-101 and L102.	2A384-26
O105	BUSHING: annealed SS; male bushing round; 13/32" lg x 5/8" OD o/a dimen; mts w/#3/8"-32 NEF-2 thd by 3/16" lg on end special features .251" dia hole thru center Raytheon part/dwg #YA 1747-1012.	For mounting A104.	2A385.2-2
W101	CABLE ASSEMBLY, RF: Radio Frequency Cable RG-58/U; coaxial; 53.5 ohms; 1,900 v rms max operating voltage; #20 AWG solid single cond, copper, plain finish; stabilized polyethylene; .116" OD; single, copper, tinned; round .195" o/a cross section dimen; black vinyl jacket; not armored; assembly 49 3/4" lg (approx); assembly 42" lg excluding terminations.	R-f lead to Radio Set AN/PRC-6.	1F425-58B

2. Identification Table of Parts for Antenna AT-249/GRD (contd.)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
O107	CAP: aluminum; black anodize; round; 1½″ OD, ¾″ o/a dimen, excluding chain; mts w/#⅛-20 NC-2 thd by ¼″ lg screw; incl chain; 16 teeth per inch 90 deg straight KNURL on end and 30 teeth per inch straight knurl around outer surface used as grounding cap; Raytheon part/dwg #YB 1747-1025.	Grounding cap.	2A387.4-3
C101	CAPACITOR, variable; air dielectric plate meshing type; 1 section; 10 uuf max. 3 uuf min.	Antenna tuning capacitor.	3D9010V-29
L101	COIL, RF: 1.55 uh at 50 mc; over-all coil form dim. 1½″ lg x ¾″ dia.	Primary of antenna transformer.	3C1084Z19-34
L102	COIL, RF: 1.99 uh at 50 mc; 1½″ lg x .495″ dia.	Secondary of antenna transformer.	3C1084Z19-33
P101	CONNECTOR, plug: Radio Frequency Plug UG-88/U; 1 round male straight type.	Plug for r-f lead to Radio Set AN/PRC-6.	2Z7390-88
O102	GASKET: neoprene; 3⅞″ lg x 2⅝″ wd x ⅛″ thk; Raytheon part/dwg #YA 1747-1031.	Case gasket.	2A1173.2-94
O110	GASKET: neoprene; .562″ OD, .060″ thk; Radio Freq Labs #H1268.	Knob gasket.	2Z3775-7
A105	HINGE SECTION: 1$^{31}/_{32}$″ lg x 1¼″ wd x 1⅞″ d o/a; Raytheon part/dwg #YB 1747-1026.	Antenna post hinge.	2A1495-1
H108	HINGE SECTION: 3⅛″ lg x .625″ wd x 1⅞″ d o/a; Raytheon part/dwg #YA 1747-1017.	Antenna post hinge section.	2A1495
H111	HOLDER, arm: two .196″ dia mtg holes on ¾″ mtg/c; Raytheon part/dwg #YB 1747-1023.	Holds loop antenna in upright position.	2A1374-5

2. Identification Table of Parts for Antenna AT-249/GRD (contd.)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
H106	INSERT, threaded: 1/4" lg (approx) x 3/8" OD; Raytheon part/dwg #YA 1747-1015.	Insert for antenna key adjustment.	2A1663
O101	INSULATION, flexible sleeve: electrical; .425" ID for 1/2" then .230" ID; .050" wall thk; 1 3/4" lg o/a; black; Raytheon part/dwg #YA 1747-1030.	Sleeving for input cable.	2G2203-1.3
O104	INSULATION: flexible sleeve: electrical; .230" ID; .050" wall thk; 3 11/16" lg o/a; black; Raytheon part/dwg #YA 1747-1019.	Sleeving for input cable.	2G2203-1.4
H110	KNOB: round; black; designed to accom shaft, 1/4" dia, 9/16" d shaft hole, set screw; brass insert; luminous green marking; 3/4" lg x 1.125" dia o/a; Raytheon part/dwg #YB 1747-1036.	To control tuning and attenuation.	2A1690-1
H103	NUT, plain, knurled: aluminum; black anodized; semifinished; 1/16 NS thd; class 2 fit; 1 5/8" OD x 3/4" h; Raytheon part/dwg #YA 1747-1032.	Case joining input cable.	6L2416-16
H105	POST, spacing: annnealed SS; round; .635" lg x .249" OD o/a dimen; mts w/#6-32 NC-2 thru ctr; Raytheon part/dwg #YA 1747-1022.	Used on the hinge assembly.	2A2998-21
R103	RESISTOR, fixed: comp; body style #14MBCA ref dwg group 2; 100 ohms; ±10%; 1/2 w power dissipation; F characteristic; .406" max lg x .175" max dia excluding term; ins; resistant to humidity and salt water immersion; 2 wire lead type term; spec JAN R-11; spec #RC20BF101K; A-B type #RC20BF101K.	Attenuating resistor.	3RC20BF101K

2. Identification Table of Parts for Antenna AT-249/GRD (contd.)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R102	RESISTOR, fixed: comp; body style #14MBCA ref dwg group 2; 47 ohms, ±10% tol; ½ w power dissipation; F characteristic; .406″ max lg x .175″ max dia excluding term; ins; resistant to humidity and salt water immersion; 2 wire lead type term; spec No. JAN R-11; spec #RC20BF470K; A-B type #RC20BF470K.	Attenuating resistor.	3RC20BF470K
R101	RESISTOR, fixed: comp; body style No. 14 MBCA ref dwg group 2; 22 ohms; ±10% tol; ½ w; F characteristic; .406″ max lg .175″ max dia excluding term; ins; resistant to humidity and salt water immersion; 2 axial wire lead term; spec. No. JAN R-11; spec type #RC20BF220K; A-B type #RC20BF220K.	Attenuating resistor.	3RC20BF220K
A103	SUPPORT, coil: round; 2″ lg x .248″ OD o/a dimen; Raytheon part/dwg #YA 1747-1013.	L101 and L102 support.	2A3393A.11
H107	SCREW, thumb: annealed SS; Navy, spec No. 46S18; black passivated; rectangular shape w/ends rounded; 5/8″ lg x 5/16″ wd .050″ thk; flat point; 8 ga; 32 NC-2 thd per inch; 7/8″ lg; Raytheon part/dwg #YA 1747-1011.	Antenna adjustment key.	6L17108-10S
O106	SHAFT: plastic; round; ½″ dia x 19/32″ lg, .245″ dia x 1″ lg; .219″ dia x 3/8″ d hole one end and .1″ lg groove; Raytheon part/dwg #YA 1747-1010.	Used on r-f tuning unit.	2A3209-1.1
O108	SLEEVE, antenna support: olive drab; irregular; 2.165″ lg x .880″ wd x 1 5/8″ h o/a; mts w/.650″ square hole thru ctr; two .144″ dia holes one each end; used to mount loop antenna arms; Raytheon part/dwg #YC 1747-1028.	Antenna support sleeve.	2A3211-28

2. Identification Table of Parts for Antenna AT-249/GRD (contd.)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
H101	STRAP, retaining: olive drab No. 7; 11 7/8" lg x 5/8" wd x 3/8" d o/a; retains loop antenna by snap assembly; one end terminated by brass tip; George T. Hoyt Co.	Holds folded antenna compact.	2A3362-4
A106	SUPPORT, antenna: 10" lg, .630" square; olive drab; mts w/.475" dia hole by 2 3/4" d on one end and .266" dia hole located 1" from end; includes two .266" dia holes, 1/2" c to c on end; designed to support loop antenna; Raytheon part/dwg #YC 1747-1016.	Antenna support.	2A3393A.1-147
S101	SWITCH, rotary: 1 sect; 2 positions; cont arrangement, non-pile up type; 1 pole, 2 throws; spring brass cont, silver plate cont finish; metal and phenolic body; 1 3/8" lg x 1 1/16" wd x 1 5/16" h; mts w/3/8-32 thd bushing 5/16" lg; flatted type shaft, 1/4" lg, 1/4" dia; solder lug term; non-shorting type cont; Grigsby Allison type #2000.	Sense switch.	3Z9825-36.21
S102	SWITCH, rotary: 1 sect; 4 positions; cont arrangement, non-pile up type; 2 poles, 4 throws; silver cont; metal body; 7/8" max lg 1 1/4" OD; mts w/3/8-32 thd bushing 5/16" lg; flatted type shaft, 7/16" lg, 1/4" dia; solder lug term; shorting type cont; Mallory type #3124.	Attenuator switch.	3Z9825-55.117